REMARKS/ARGUMENTS

In paragraph 2 of the Office action, the examiner states that the Information Disclosure Statement filed 10/20/2003 did not contain the required legible copy of each non-patent literature publication. In response, a copy of form PTO/SB/08B and copies of the two publications listed on that form are filed herewith.

In paragraph 3 of the Office action, the examiner states that serial numbers and dates are missing from paragraph [0044] of the specification as published. Appropriate amendments have been made to paragraph [0044].

Double Patenting

In paragraph 5 of the Office action, claims 1-16 and 18-21 stand provisionally rejected on the grounds of nonstatutory, obviousness-type, double patenting as being unpatentable over claims 1-20 of copending Application No. 10/689,336. Because this is a provisional rejection, applicant will address this rejection when allowable subject matter is indicated.

In paragraph 8 of the Office action, claims 1-7, 12-15, 18, and 21 stand provisionally rejected on the grounds of nonstatutory, obviousness-type, double patenting as being unpatentable over claims 1-7, 11-14, 17, and 20 of copending Application No. 10/689,312 (the '312 application). Applicant respectfully traverses that rejection for the following reasons.

Applicant respectfully disagrees with the examiner's characterization of the relationship between the pending claims and the claims of the '312 application. Specifically, the examiner asserts that "the only difference is the substitution of 'determining a sum weighted deviation' in the present application with the step of 'determining a running partial deviation sum' in copending Application No. 10/689,312." In claim 1 of the '312 application, the local deviation is calculated from the local mean number and a running partial deviation sum is determined for each of the plurality of processing elements. In contrast, in the present application, claim 1 recites determining a sum weighted deviation from said local deviations for one-half of said loop in an anti-clockwise direction and determining a sum weighted deviation from said local deviations for one-half of said loop in a clockwise direction. A clockwise transfer parameter and

an anti-clockwise transfer parameter are determined from the sum weighted deviations. Applicant asserts that the determination of sum weighted deviations for one-half of the loop in a clockwise direction and sum weighted deviations for one-half of the loop in an anti-clockwise direction in place of determining a running partial deviation sum would not have been obvious to a person of ordinary skill in the art. The alleged motivation of "the desire to have a greater variety of choices when performing the claimed load balancing method" does not provide a legal analysis justifying the conclusion that the claims of the instant application are obvious in view of the claims of the '312 application. For the foregoing reason, applicant respectfully requests that the double patenting rejection of claim 1-7, 12-15, 18, and 21 on the basis of copending Application No. 10/689,312 be withdrawn.

35 U.S.C. § 101

In paragraphs 11 and 12 of the Office action, claim 21 stands rejected under 35 U.S.C. § 101 for reciting "a memory device." In response, claim 21 has been amended to recite "a computer readable memory device." Claims to a "computer readable medium" are authorized in the Interim Guidelines for Subject Matter Eligibility, in the section dealing with "practical application." It is believed that claim 21, as amended, is in compliance with the interim guidelines such that the 35 U.S.C. § 101 rejection should be withdrawn.

35 U.S.C. § 112

In paragraph 14 of the Office action, claims 1-21 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In paragraph ai, the examiner states that in claims 1, 12, and 21 "calculating a local mean number of tasks within each of said plurality of processing elements" is unclear. Applicant respectfully disagrees. The claims are read in light of the specification, and the specification discloses at least one method of calculating a local mean. See the published application beginning with paragraph [0043]. Applicant asserts that one of ordinary skill in the art would know how to calculate a local mean based on the disclosure in the specification. Applicant should not be required to write a preferred embodiment into the claims. Further, a very similar

limitation appears in claim 1 of copending application 10/689,312 which has been examined by this same examiner without objection to that language. Applicant respectfully requests that the examiner reconsider this rejection.

In paragraph ai, the examiner next states that in line 11 it is unclear whether the local deviation determining step is performed based on the preceding step. Claims 1 and 21 have been amended to make it clear that the local deviation is calculated from the local mean number. See paragraph [0048] of the published application. Claim 12 already has such language.

In paragraph ai, the examiner next states that in lines 12-17 it is unclear how a sum weighted deviation is defined. Claims 1, 12, and 21 have been amended to recite that the sum weighted deviations are determined from the local deviations. See the published application beginning with paragraph [0049].

In paragraph ai, the examiner next states that in lines 18-19 it is unclear whether the transfer parameters are based on the results of the preceding steps. Appropriate language tying the steps together has been added to claims 1, 12, and 21. See the published application beginning at paragraph [0053].

In paragraph aii, it is the examiner's position that it is unclear what is meant by the "V" in claims 4 and 14. Each of claims 4 and 14 has been amended to recite that "V" is the total number of tasks. The examiner also indicates, with respect to "E_r", that it is unclear how that value is determined for each of the plurality of processing elements. The examiner's attention is respectfully directed to paragraph [0045] of the published application which provides:

> The rounding function $M_r = Trunc((V + E_r)/N)$ prevents tasks from being lost or gained (where M_r represents the local mean for PE_r, $2N$ represents the total number of PEs 30 in the loop 50, and E_r represents a number in the range of 0 to $(N-1)$). In the current embodiment, each PE is assigned a different E_r value for controlling the rounding. The simplest form for the function E is the case in which $E_r = P_r$, where P_r represents the PEs position in the loop. For example, for PE_0, $E_0 = 0$; for PE_1, $E_1 = 1$; for PE_2, $E_2 = 2$; etc. By assigning each PE in the loop a different E_r value, the rounding function can be controlled such that some of the local means are rounded up and some of the local means are rounded down, thus insuring that $V = \sum_{i=0}^{i=N-1} M_i$. It should be noted that in the current

> embodiment, the local mean for each PE 30 in the loop is computed in parallel with the local means of the other PEs in the loop.

It is submitted that reading claims 4 and 14 in view of the disclosure of paragraph [0045], one of ordinary skill in the art would understand how the value E_r is derived for each of the plurality of processing elements. With respect to claim 14, a definition has been provided for PE_r.

In paragraph aiii, the examiner indicates that it is unclear in claims 5 and 15 how E_r "controls" the *Trunc* function. The language of claim 5 and claim 15 has been amended to recite that the *Trunc* function is responsive to the value of E_r. With respect to the examiner's question about how this step is possible, "since each E_r value is set ahead of time and must be different for each processing element," the examiner's attention is respectfully directed to paragraph [0045] reproduced above. The parentheticals have been removed from claims 5 and 15.

With respect to paragraph aiv, the examiner states that the recitation of "X and (X+1)" in claim 6 is unclear. The examiner's attention is respectfully directed to paragraph [0014] of the published application which provides as follows:

> The present invention enables tasks to be distributed along a group of serially connected PEs so that each PE typically has X number of tasks or (X+1) number of tasks to perform in the next phase. The present invention may be performed using the hardware and software (i.e., the local processing capability) of each PE within the array. Those advantages and benefits, and others, will become apparent from description of the invention below.

The examiner's attention is also directed to the table appearing in paragraph [0047] of the published application which provides:

PE_r	v_r	E_r	$(V+E_r)/N$	$M_r = Trunc((V+E_r)/N)$	D_r
PE_0	3	0	5.375	5	-2
PE_1	6	1	5.5	5	1
PE_2	2	2	5.625	5	-3
PE_3	7	3	5.75	5	2

PE_4	8	4	5.875	5	3
PE_5	5	5	6	6	-1
PE_6	5	6	6.125	6	-1
PE_7	7	7	6.25	6	1

Table #1 – Local Mean Calculation for the Loop 50 ($V = 43$, $N = 8$).

The language of claim 6 has been amended to indicate that a local mean for each group is equal to either X, or X+1, as seen clearly from Table No. 1 where X = 5 and X+1 = 6. The definition of the local mean has been conformed to the definition found in claim 4 .

In paragraph av, the examiner indicates that in claims 8 and 9, it is unclear how the weighting is determined and whether the weights for each of the PE's can be different for each of the assigning PE's. The examiner's attention is respectfully directed to the published application beginning with paragraph [0049] which provides:

> After the local deviations are computed in operation 63, the sum weighted deviation in the anti-clockwise half of loop (A) is determined for each PE in operation 64. The anti-clockwise sum (A) is then formed in a similar manner as that used to form the partial value sum (V) in operation 61. In operation 64, however, a weighing factor (w_r) is assigned to each PE and the local weighted deviations ($w_r D_r$) are then rotated halfway around the loop in clockwise direction and summed. In the current embodiment, greater weight is given to those PEs that are located closer to the selected PE (i.e., PEs that are closer to the selected PE have a greater weighing factor (w_r)). For example if PE_2 is the selected element, then weighing factors are assigned to PE_1, PE_0, and PE_7 such that $w_1 > w_0 > w_7$. The sum weighted deviation in the anti-clockwise half of loop can be represented by the equation: $A = \sum_{i=1}^{i=(N/2)-1} w_i D_i$.
>
> After the sum weighted deviation in the anti-clockwise half of loop (A) is determined in operation 64, the sum weighted deviation in the clockwise half of loop (C) are determined for each PE in operation 65. The clockwise sum (C) is formed in a similar manner as that used to determine the anti-clockwise sum (A) in operation 64. In operation 65, however, the local weighted deviations ($w_r D_r$) are rotated halfway around the loop in an anti-clockwise direction and summed. As discussed in conjunction with operation 64, greater weight is given to those PEs that are located closer to the selected PE (i.e., PEs that are closer to the selected PE have a greater weighing factor (w_r)). Again if PE_2 is the selected element, then weighing

factors are assigned to PE_3, PE_4, and PE_5 such that $w_3 > w_4 > w_5$. The sum deviation in the clockwise half of loop can be represented by the equation:

$$C = \sum_{i=(N/2)+1}^{i=N-1} w_{-i} D_{-i} .$$

FIG. 5 illustrates how the sum weighted deviation in the anti-clockwise half of loop (A) and the sum weighted deviation in the clockwise half of loop (C) is determined for PE_2. As seen in FIG. 5, the sum weighted deviation in the clockwise half of loop (C) is determined by combining PE_3, PE_4, and PE_5 into a "super PE". The sum weighted deviation of this super PE is C=Sum($w_3D_3 + w_4D_4 + w_5D_5$). Likewise, the sum weighted deviation in the anti-clockwise half of loop (A) is determined by combining PE_1, PE_0, and PE_7 into another "super PE". The sum deviation of this super PE is A=Sum($w_1D_1 + w_0D_0 + w_7D_7$). It should be noted that in the current embodiment no weight is given to PE_6.

Referring to Table #1, the sum deviation in the clockwise half of loop (C) using this super PE is $w_3D_3 + w_4D_4 + w_5D_5 = w_3(2) + w_4(3) + w_5(-1)$. If weighing factors are assigned to PE_3, PE_4, and PE_5 as discussed above, for example in the current embodiment, $w_3 = 3$, $w_4 = 2$, and $w_5 = 1$, then $C = 3(2) + 2(3) + 1(-1) = 11$. Likewise, the sum deviation in the anti-clockwise half of loop (A) using the other super PE is $w_1D_1 + w_0D_0 + w_7D_7 = w_1(1) + w_0(-2) + w_7(1)$. Again, if weighing factors are assigned to PE_1, PE_0, and PE_7 as discussed above, for example in the current embodiment, $w_1 = 3$, $w_0 = 2$, and $w_7 = 1$, then $A = 3(1) + 2(-2) + 1(1) = 0$.

It is respectfully submitted that when claims 8 and 9 are read in conjunction with the specification, the determination of the weighting is clear to one of ordinary skill in the art.

In paragraph av, the examiner states that it is unclear in claim 10 whether "S," which represents the deviation of a selected processing element, is the same as the local deviation in claim 1. Claim 10 has been amended to eliminate any ambiguity.

In paragraph avi, the examiner states that it is unclear in claim 11 what is meant by the variables Δ and Mag. Claim 11 has been amended to clarify the relationship between the parameters. See paragraphs [0059] and [0060] of the published application.

In paragraph avii, the examiner states that it is unclear in claim 12 how the insertion of the phantom element relates to the rest of the recited steps. Claim 12 has been amended to indicate that the phantom element is inserted when there is an odd number of processing elements in the loop. The phantom element is assigned a local deviation of zero. Support for

this amendment can be found in paragraph [0058] of the published application and original claim 16.

In view of the foregoing, it is respectfully requested that the rejection of claims 1-21 under 35 U.S.C. § 112, second paragraph, be withdrawn.

35 U.S.C. § 103

In paragraph 16 of the Office action, claims 1-16 and 18-21 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Smith (U.S. Pub. No. 2004/0024874) in view of Wheat (U.S. Patent No. 5,630,129). Applicant respectfully traverses that rejection.

It is the examiner's position that both Smith and Wheat teach methods of load balancing. Although that assertion is correct, the methods of load balancing taught by Smith and Wheat are so different from one another, and different from what is claimed, that it is not possible for the combination of those two references to suggest the claimed invention.

The examiner asserts that Smith discloses "determining a clockwise transfer parameter and an anti-clockwise transfer parameter for each of said plurality of processing elements" citing paragraphs 18-20 of Smith. Smith does not calculate a transfer parameter as asserted by the examiner. Smith merely compares the workloads of pairs of processors, and the processor having the lower level of work simply requests work from the processor having a higher level of work. There is no transfer parameter calculated. This is made clear in Smith, paragraph [0038], which recites in part:

> With a uni-directional link from processor A 13 ("upstream") to processor B 14 ("downstream"), A informs B of how much workload it has, B then compares this with its own level of workload, and if B is less loaded than A, then it requests work from A. It is therefore ensured that B has at least as much work as A. Such pairs are linked end to end in a chain, with all the links going in the same direction, with the ends of the chain joined together. This forms a closed loop with all the workload transfers travelling in the same direction. Since in each pair the one downstream of the link has at least as much work as the one upstream, and every processor in every pair downstream of another processor, it ensures that the entire ring is inherently balanced.

The examiner asserts that Smith teaches "redistributing tasks among said plurality of processing elements in response to said clockwise transfer parameter and said anti-clockwise parameter for each of said plurality of processing elements" citing paragraph [0020] of Smith. As discussed above, Smith does not operate in such a manner so as to generate transfer parameters. Accordingly, the redistribution does not take place in response to transfer parameters. Redistribution takes place in Smith in response to a request from one processing element, having a lighter workload, made to another processing element having a heavier workload.

The examiner acknowledges that Smith does not teach "determining a total number of tasks present within said loop; calculating a local mean number of tasks for each of said plurality of processing elements; [or] determining a sum weighted deviation within each for each of said plurality of processing elements for one-half of said loop in a clockwise and an anti-clockwise direction." From that admission and the previous arguments, it is thus seen that Smith, although it does deal with load balancing, operates in such a completely different manner that it discloses none of the steps of claims 1, 12, and 21.

The defects of the primary reference to Smith are not overcome by Wheat. The examiner asserts in paragraph 20 that "Wheat teaches a dynamic load balancing method by determining the average load across a processor array and minimizing a global imbalance or [*sic* of] workloads within a finite number of balancing steps" citing column 6, lines 58-67. Although the cited portion of Wheat does discuss a "global imbalance," this is part of a discussion in which Wheat proves that his method minimizes the global imbalance. The actual method is set forth beginning in column 5, line 50, with a determination of workloads. Workloads are then compared amongst processors. See column 5, lines 60-67, which provide:

> Each processor compares its work load to the work load of the other processors in its neighborhood and determines which processors have greater work loads than its own. If any are found, it selects the one with the greatest work load (ties are broken arbitrarily) and sends a request for work to that processor. Each processor may send only one work request, but a single processor may receive several work requests.

Transfers take place according to priorities as discussed in column 6, lines 40-57, which provide as follows:

> FIG. 4 illustrates an example of element priorities and selection for exporting four elements to the east neighboring processor. Initially, elements 3, 6, 9, and 12 are eligible for export. Their priorities are computed; element 3, for example, has priority -2, since it has two local neighbors (-2), one neighbor in a concerned partner processor (-2), and one neighbor in the importing processor (+2). Elements 6 and 9 share the highest priority, but since element 6 has a greater work load, it is selected. Element 5 becomes eligible for export, but its priority is low since it has three local neighbors. The priorities are adjusted, and element 9 is selected, making element 8 a candidate. The priorities are again updated, and the selection process continues with elements 3 and then 12 being selected. Although the work request is not completely satisfied, no other elements are exported, as the work loads of the elements with the highest priority, 5 and 8, are greater than the remaining work request

It is seen that Wheat, although disclosing a method for dynamic load balancing, teaches a very different method than either the claimed invention or Smith. Processor work requests are determined based on processors comparing their workloads with other processors. Requests are then made and granted on the basis of priorities. There is no calculating a local mean number of tasks, calculating a local deviation, using the local deviations to determine sum weighted deviations for one-half the loop in an anti-clockwise direction and for one-half the loop in a clockwise direction, determining clockwise and anti-clockwise transfer parameters from the sum weighted deviations, or redistributing tasks based on the transfer parameters. It is respectfully submitted that the load balancing techniques of Smith and Wheat are so dissimilar from one another, and so dissimilar from the claimed invention, that no possible combination of the teachings of the two references renders obvious claims 1-21. For the foregoing reasons, applicant respectfully requests that the 35 U.S.C. § 103 rejection of independent claim 1 based on the combination of Smith and Wheat be withdrawn.

With respect to paragraphs 25 and 26 of the Office action and claim 4, the Office relies upon official notice for the proposition that "it is well known to perform a local mean calculation using this method and using a truncation function to remove unnecessary decimals." While such a function may be well known in the art, the methods of Wheat and Smith are complete in themselves. The effort to graft an unnecessary step onto the methods of Wheat and Smith

through the use of official notice is nothing more than an improper hindsight reconstruction. The rejection of claim 4 should be withdrawn.

With respect to paragraphs 27 and 28 and claim 5, the Office provides no basis for the conclusion that "it would have been obvious . . . to change the value of E_r." The examiner provides no basis for where that teaching is found; there is no citation to the art of record and no reliance upon official notice. The Office appears to be using applicant's disclosure as a basis for a hindsight reconstruction of claim 5.

With respect to paragraphs 29 and 30 of the Office action and claim 6, neither Smith nor Wheat teaches calculating a local mean. Thus, it is difficult to understand how the references can disclose the details of claim 6 when the broad concept of calculating a local mean is not even disclosed.

With respect to paragraphs 31 and 32 of the Office action and claim 7, because neither Smith nor Wheat discloses determining a local mean, one of ordinary skill in the art would not be interested in calculating a local deviation, by any means. The Office appears to be using applicant's disclosure as a basis for a hindsight reconstruction of the claim.

With respect to paragraphs 33-34 of the Office action and claims 8 and 9, the examiner provides no basis for where the missing teachings are found; there is no citation to the art of record and no reliance upon official notice. The Office appears to be using applicant's disclosure as a basis for a hindsight reconstruction of claims 8 and 9.

With respect to paragraphs 35-38 of the Office action and claims 10 and 11, neither Smith nor Wheat discloses determining clockwise and anti-clockwise transfer parameters. Given that recognition, it is difficult to understand how the references can disclose the details of claims 10 and 11 when the broad concept of transfer parameters is not even disclosed.

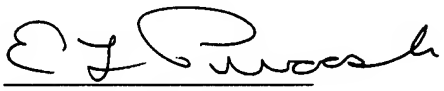
The same arguments presented above are applicable to claims 12-18 and 19-21.

Applicant's failure to argue the patentability of any particular dependent claim should not be viewed as an acquiescence in the Office's position. Applicant reserves the right to argue the patentability of any of the dependent claims at a later date should become necessary.

Request for Interview

Applicant has made a diligent effort to place the instant application in condition for allowance. If the examiner is of the opinion that the instant amendment does not place the currently pending claims in condition for allowance with respect to the art of record, the examiner is respectfully requested to contact applicant's attorney at the telephone number listed below **so that an interview may be scheduled before the issuance of a final Office action rejecting the claims on the basis of the art currently of record**.

Respectfully submitted,



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